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Consequently, if β represent the angle at base of the cone of maximum volume under total surface, we shall have

$$\sin \theta_1 = \sin \beta.$$

The angle at the summit of the cone of maximum volume under its conical surface is, therefore, equal to the angle at the base of the cone of maximum volume under its total surface, and the theorem announced immediately follows. It also readily appears that upon the same base the cone of maximum volume under total surface is double that of maximum volume under conical surface.

Rev. William Reeves, D. D., read the first part of a paper "On the Ancient Order of Culdees in Ireland."

Robert M'Donnell, M. D., read a paper—

ON THE ORGANS WHICH IN THE COMMON RAY ARE HOMOLOGOUS WITH THE ELECTRICAL ORGANS OF THE TORPEDO.

The very beautiful structures which exist in the electric as well as the non-electric rays, as appendages of the anterior branches of the fifth pair of nerves, were regarded by Geoffroy St. Hilaire and others as the representatives of the electric organs of the torpedo. The fact, however, of their existence in the torpedo along with, although not united with, the electric organs, is sufficient to render this view untenable.

1. Savi, who has given an accurate description of them in the torpedo, as well as a beautiful drawing, considers them as an apparatus for the secreting of mucus. For reasons, however, not to be entered on at present, the view taken by Jacobson, Treviranus, and, more recently, by Leydig, that these are organs of sensation, seems the correct one.

2. The existence of the true so-called "system of the lateral line" in the electric, as well as the non-electric fishes, enables us also to set aside this apparatus as not being homologically related to the electric organs, as has been supposed by some authors.

3. The organ described by its discoverer, Dr. Stark, of Edinburgh, as an electrical apparatus, in the tail of the flapper skate and other rays, on account of its form and position, can hardly be considered the true homologue of the electric organ of the torpedo; nor am I aware that any of the authors who have examined it have, in their subsequent researches concerning this tail-organ, put forth such a notion. Possibly the pseudo-electric tail-organs of the rays may yet be shown to be homologically related to the electric organs of the *Gymnotus electricus*.

I believe, however, that I have lately discovered in the non-electric rays the organs which are the true homologues of the batteries of the torpedo; and it is the object of the present communication to indicate the anatomical relations of these organs, and briefly to state how I have been led to make them out.

If the skin be carefully removed from the upper surface of the head and the anterior half of the back of a common skate, the following parts at once come into view:—

1st. The dorsal aspect of the branchial chambers.

2nd. A band of tubes filled with crystalline jelly (a bundle of the muciferous tubes of Savi), running from a centre, external to the gills, inwards, and a little backwards, but a little way behind the temporal orifice.

3rd. A muscle arising from the cartilage close to the posterior branchial arch, but nearer the middle line, and running forwards underneath the bundle of tubes just mentioned, to terminate in a long, delicate tendon, passing to the extremity of the snout.

If this bundle of tubes be raised, and drawn forwards, and the little fleshy belly of the snout-muscle drawn outwards, in the angle formed between them will be found the organ sought for; but probably it may remain invisible until a drop or two of tolerably strong acetic acid being brought in contact with it, it is thus revealed as distinct from the gelatinous tissue which surrounds it. Thus brought into view, we find a little mass, varying in length from $\frac{3}{4}$ of an inch to $1\frac{1}{2}$ inches, wedged in between the occipital muscles internally, and the branchiæ and their thin muscular coverings externally, covered superficially by the tubes and snout-muscle, already mentioned, and dipping downwards so as to reach the nerve-branches of the vagus going to the gills.

Viewed with the naked eye, this mass seems to consist of a number of quadrangular and pentangular bodies of somewhat irregular form and size, united together by areolar texture, and packed beside one another in a vertical position. Seen in the microscope, it is found to be composed of granular, nucleated substance, and larger cells of a peculiar character, seemingly more or less immediately connected with the nervous ramifications, the whole entangled in a very abundant areolar tissue. But it is to the nerves of this little body that I wish to direct special attention: its small size makes it at once obvious that its supply of nerves cannot be very large; yet, on careful dissection of large skates, I have found that it gets minute nerve-twigs from the branches of the vagus supplying the gills, and that it also receives a larger and more easily discovered branch from the fifth, which, on close examination, proves to be closely related to that which constitutes the first electric nerve of the torpedo.

Thus, as I have satisfied myself by dissection, as well as from Savi's beautiful plate and description, that the posterior branch of the fifth pair in the torpedo, passing out from the cranium, immediately behind the temporal orifice, divides into four branches:—

1. For the muciferous tube system (of Savi).
2. For the mucous membrane of the mouth.
3. For the muscles of the jaws.
4. For the electric organ.

The same nerve in the skate, also to be discovered just behind the temporal orifice, gives off, immediately after escaping from the cranial cavity, similar branches, supplying—

1. A very large branch to the muciferous tube system (Savi).
2. The mucous membrane of mouth.
3. One to the muscles of the jaws from which the small branch,
4, Going to the organ just described, is derived.

On the following grounds, therefore, is based the opinion, that this little organ is truly the homologue of the electric organ of the torpedo: its position and relative anatomy, its structure, its nervous supply; and, moreover, that I have not found it present in the torpedo, which, through the kindness of Dr. E. Perceval Wright, I have had an opportunity of dissecting.

Let me state, however, with reference to this last assertion, that I am unable to say positively that the organ in question does not exist in the torpedo; for, in those which are to be found in the museums of Dublin, it is possible that they may have been removed in the dissections already made, which may also have been the case in that placed in my hands by Dr. E. Perceval Wright.

If further research shall show that these organs co-exist in the torpedo with the electric batteries, then, of course, the idea of them being homologous organs falls to the ground.

It may occur to some, also, as it did at first to myself, that the bodies which I have described may be related to the "follicular nervous apparatus" ("appareil folliculaire nerveux" of Savi), existing in the torpedo, but not in the non-electric rays; but I conceive that the consideration of the structure and nervous supply is sufficient to negative such a notion.

In that chapter of Mr. Charles Darwin's book on the "Origin of Species," in which he speaks of those difficulties on the theory of descent with modification, some of which are so grave, that he tells us that to this day he cannot reflect on them without being staggered, and which have much more than staggered many of his readers, the learned author mentions the electric organs of fishes as a case of special difficulty.

Here was a case, indeed, of special difficulty, obvious to every reader. How, on the view of common descent, could we conceive, that while these wondrous organs were brought to such a condition of development and power in the torpedo, that in the immediate members of the same family, no trace of such structures was known to exist?

It seemed impossible, or at least in the highest degree improbable, that if the Raiidæ had, in even countless ages past, sprung from a common ancestor, the electric batteries of the torpedo should be without their homological representatives in other rays. Yet no candid inquirer could grant that either the mucous tube apparatus, the lateral line system, or indeed the pseudo-electric tail-organs, fulfil the necessary conditions.

Considering, then, the great size and peculiar origin of the nerves going to the electric organs of the torpedo, it seemed that a very close and accurate dissection of the corresponding nerves of the skate was likely to afford some clue to any atrophied or modified electrical apparatus, if any such existed in that animal: by following this course, I have made out the organs already described.

The following donations were presented to the Academy :—

By Arthur B. Cane, Esq.: a large, white cedar chest, ornamented in front with the royal arms and the letters "I. R.," supposed to have been part of the baggage of King James II.

By Rev. John Hamilton: a silver coin of Elizabeth, and another of Philip and Mary, both found near Manorhamilton.

By Mrs. Thomas Townsend: part of the upper stone of a quern, rudely ornamented with a cross; found at Smithville, Castle-Townsend.

By Rev. C. P. Meehan: a copper axe-head, 4¾ inches long, and another, made of bronze, 7¾ inches long, both found in the county of Louth; some fragments of four different bronze swords; a cannon-ball, weight 2¾ lbs., found near the Obelisk, on the bank of the Boyne.

Thomas Devine, Esq., of the Crown Lands Department, Canada, presented a collection of 45 different specimens of timber, all of native growth, and used in the arts; also, two copies of his map of Canada.

William P. Pike, Esq., presented a collection of autographs.

Sir Thomas Deane presented Hogan's head of Minerva, carved in wood, his first attempt at classic art.

STATED MEETING, FRIDAY, NOVEMBER 30, 1860.

James Henthorn Todd, D. D., President, in the Chair.

Read,—The following letter, addressed to the President of the Academy :—

Ordnance Survey Office, Dublin, 29*th November*, 1860.

Sir,—I am directed by Colonel Sir Henry James, Royal Engineers, Superintendent of the Ordnance Survey, in compliance with the request contained in your letter of the 4th August, 1857, to his Excellency the Lord Lieutenant, and in accordance with the authority of the Right Honorable the Secretary of State for War, to forward to you, for presentation to the Royal Irish Academy, 103 volumes of MS. papers, containing information relating to the local history and antiquities of Ireland, collected during the progress of the Ordnance Survey; together with 11 volumes of sketches of various objects of antiquarian interest.

A list of the volumes is enclosed.

I am also to state, that the delay which has occurred in presenting these papers has been caused by the necessity which existed for arranging, indexing, and otherwise preparing the volumes for binding, which has been a work of very considerable labour, and could only progress as the other avocations of those competent to the task would permit.

I am further to inform you that a considerable number of additional volumes are now ready for binding, and will very shortly be presented to the Academy.

I have the honour to be, Sir,
your obedient servant,
George A. Leach, Lieut.-Colonel, R. E.